ASIAEX Horizontal Internal Wave Array

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LONG-TERM GOAL

Our goals are to understand the physics of acoustic/internal wave interaction on the continental shelves, the acoustic signal variability resulting from such interaction, and the dynamics of the shelf internal waves.

OBJECTIVES

We wish to measure internal waves in the vicinity of an acoustical propagation experiment that will be conducted in spring 2001 as part of the ONR Asian Seas International Acoustics Experiment (ASIAEX). We wish to determine the primary features of internal waves propagating past the acoustic equipment with many inexpensive moorings. Our objective is to obtain broad horizontal coverage at the sacrifice of vertical detail at any single site.

APPROACH

We will emplace twenty moorings, each containing three temperature sensors placed near the strongest portion of the main thermocline. The many moorings will enable continuous two-dimensional horizontal wave mapping, allowing study of wave formation, wavefront interaction, refraction, and energy flux. We anticipate that towed hydrographic measurements will be conducted during the experiment, enabling accurate calculation of internal-wave displacements. The data will be combined with other moored sensors in the area and with synthetic aperture radar images to give the best possible temporally continuous picture of the wavefield. The array size will be between 9x12 km and 15x20 km, depending on characteristics of nonlinear internal waves at the site. The goal is for internal waves to be coherent between the moorings, enabling unambiguous mapping.

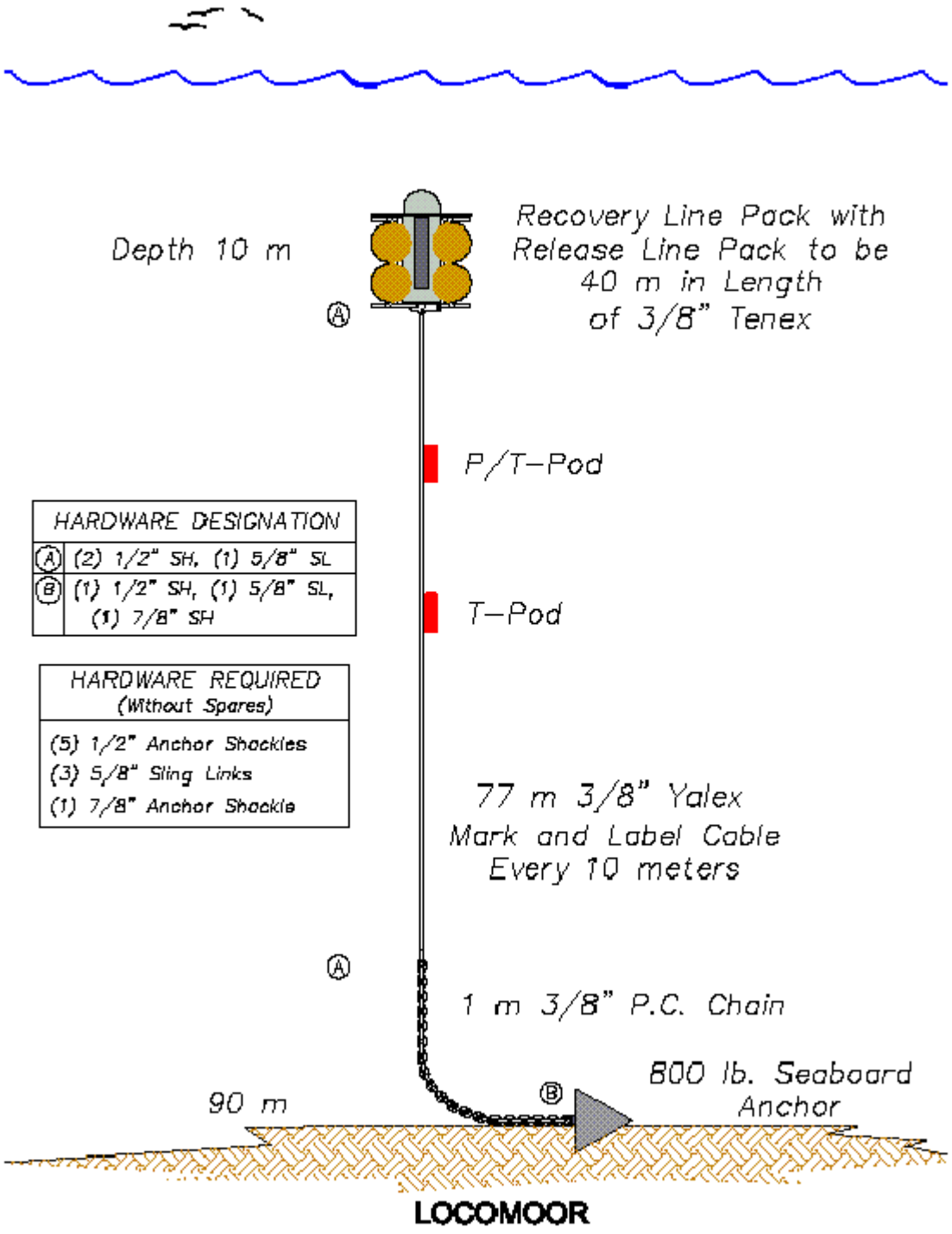

Figure 1: Components of the Low-Cost Mooring, LOCOMOOR, are shown.

Figure 2. Testing of the release/recovery package off the WHOI dock. The Edge Tech acoustic release can be seen as the yellow cylinder on the line canister, facing the camera. Eight additional flotation spheres are attached around the PVC line canister by aluminum brackets, which have since been redesigned to include a large recovery bail. A recovery float ball is seen at the top center of the package, closing the line canister. The ball is held with an acoustic command release.

WORK COMPLETED

We have designed the mooring systems, Figure 1. Primary components are an anchor, a commercial release (Edge Tech) incorporated into an upper float unit fabricated at WHOI (Figure 2), and self-contained commercial temperature and pressure sensors lashed to the mooring rope. The releases operate under acoustic command, bringing a recovery line to the surface. The mooring response to currents has been modeled with the WHOI CABLE mooring response program. The moorings are restricted to water less than about 150 m depth; we intend to deploy them in waters of 90 to 100 m depth. The largest solitary waves which exist in the South China Sea (5 knot currents) should not drag the moorings but will depress the floats to near the bottom for a few minutes. Waves with one or two knot currents will not depress the floats more than a few meters (measured with a pressure gauge) and will be measurable with this system.

Four moorings have been assembled for test purposes. Two were launched in the April 2000 ASIAEX preliminary survey cruise in the East China Sea and were lost to fishing activity, as were two large, heavy moorings at the same site. The LOCOMOORs for the 2001 acoustic experiment are being fabricated. We had hoped to fabricate the moorings for 5000 dollars each, but the upper float has been strengthened with respect to the original design and the true cost is closer to 6000 dollars.

IMPACT/APPLICATIONS

The mooring design and components are likely to be used in other coastal applications.

RELATED PROJECTS

The wave field measurements are to be made in conjunction with the ASIAEX acoustic propagation experiment conducted by ONR Ocean Acoustics. Two of the PI's are Orr (NRL) and Lynch (WHOI)

PUBLICATIONS

Jeff Lord, Jim Irish, Tim Duda, and John Kemp, LOCOMOOR: A LOw-COst MOORing for the Measurement of Internal Solitary Waves, in *Proceedings of the 2000 MTS/IEEE Buoy Workshop*, in press.